Distributed Generation and CHP for Federal Facilities

Snapshot of DG & CHP Technologies: Advantages, Disadvantages, Costs and Benefits

Newport Beach, CA

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What Is DG?

- Distributed generation (DG) is the use of small-scale power generation technologies located close to the load being served.
- <1kW to 50MW typical

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Benefits of DG

- Reduce electric energy and demand costs
- Combined Heat and Power
- Manage peak demand
- Improve power quality and reliability
- More self-reliant
- Defer T&D capital investments
- Eliminate T&D electrical line losses

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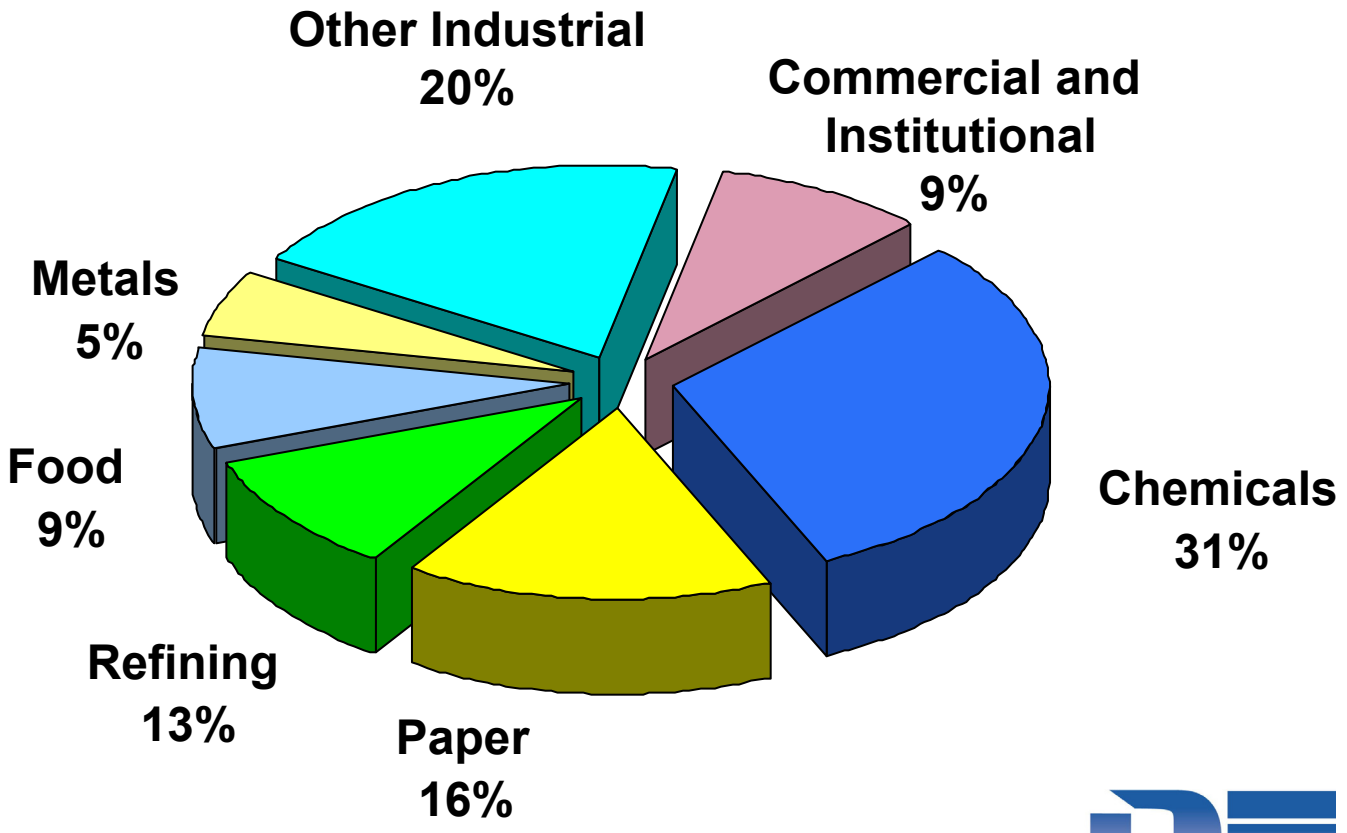
Existing CHP

- *Existing CHP Capacity (1999) 52,800 MW*



Source

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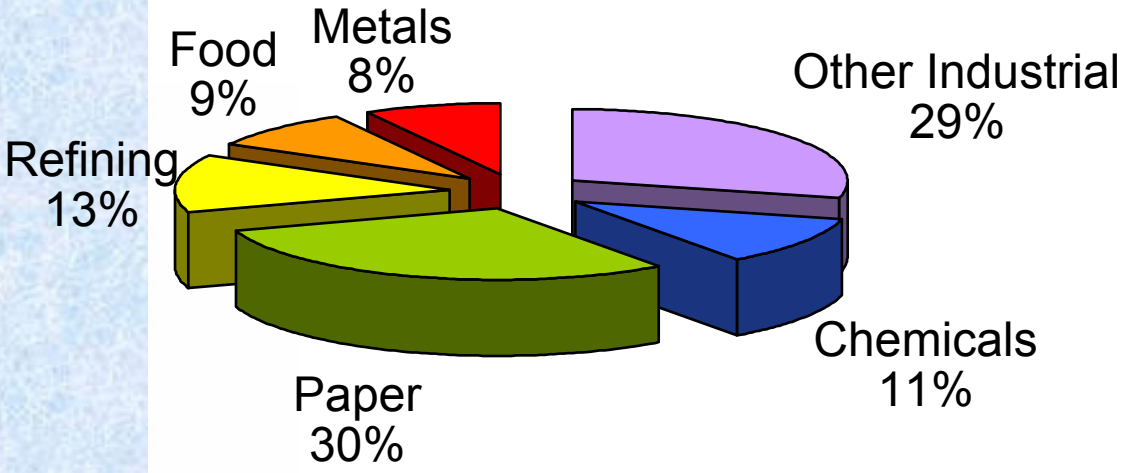
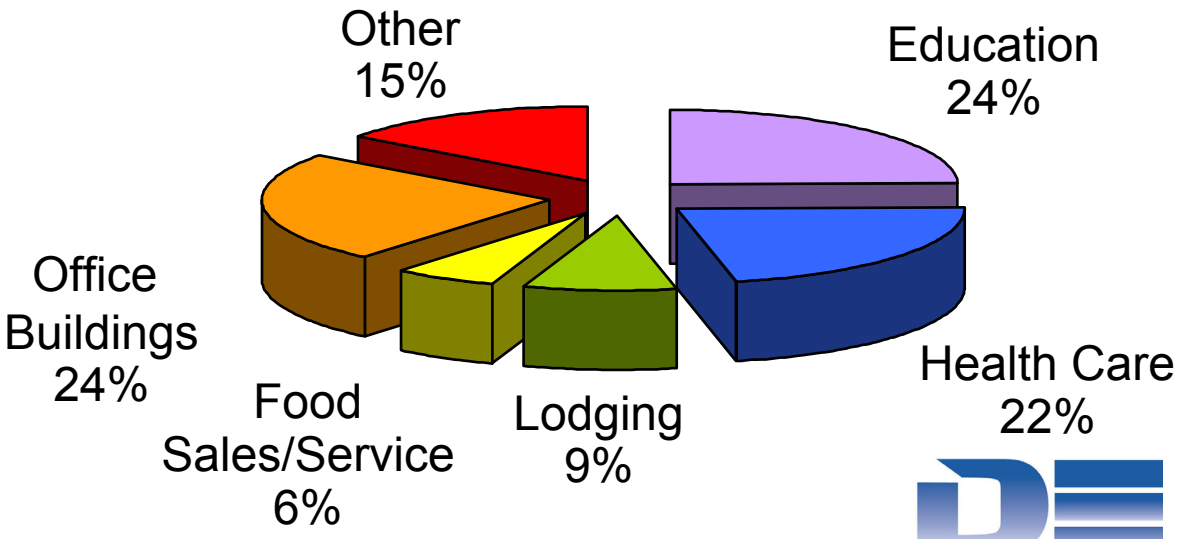
Broad CHP Opportunities Remain



Industrial Sector
90 - 100 GW
of Additional
DG Potential

Commercial Sector
75 to 100 GW
of New
DG Potential



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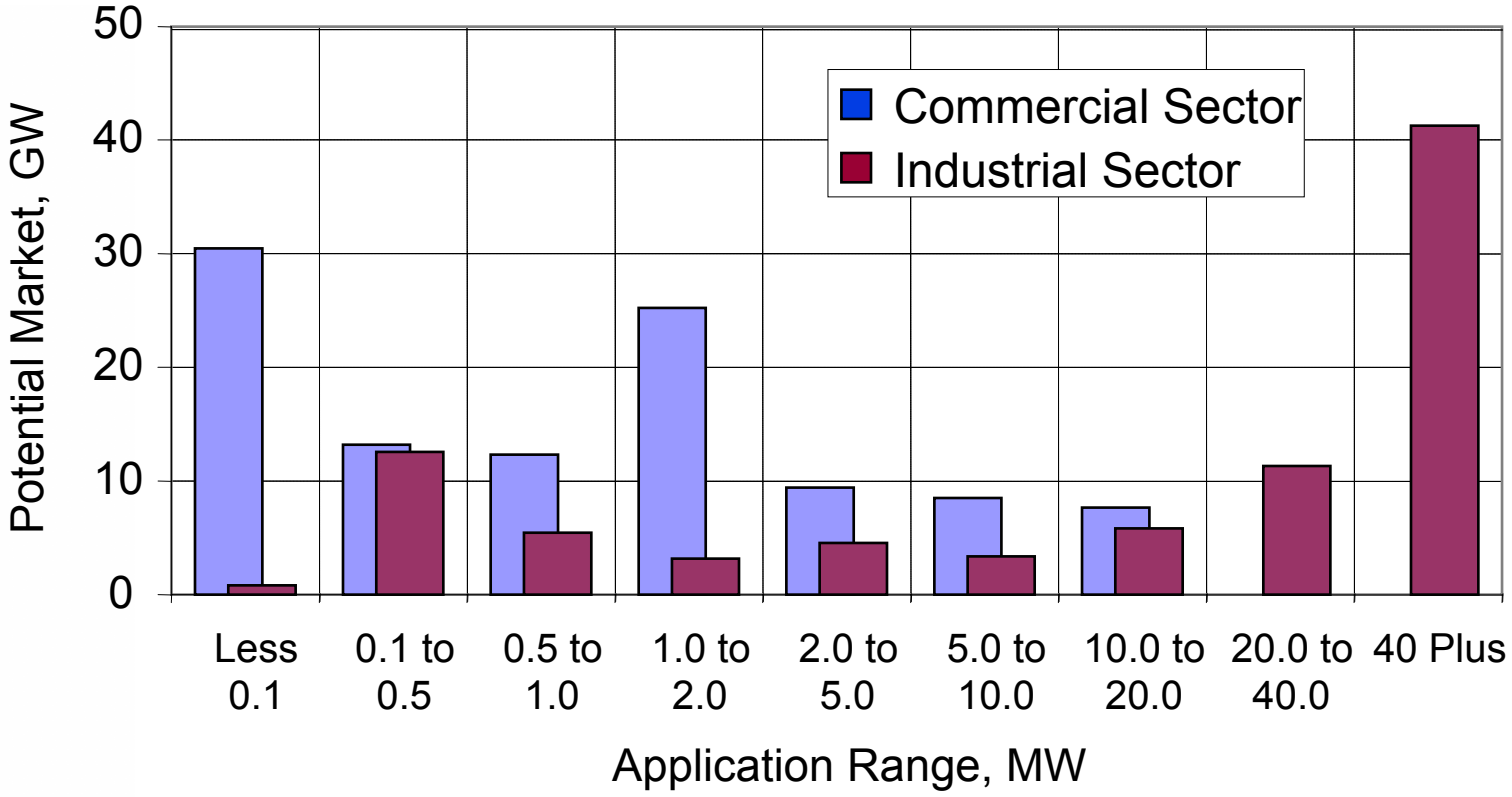
US CHP Market Opportunities



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DG Technologies

DISTRIBUTED-POWER TECHNOLOGIES

Technology	Size Range	Operation	Efficiency	Availability
Reciprocating Engine (gas or diesel)	500 kw–5 Mw	Internal combustion	30–36%	Commercial
Industrial Gas Turbine	1–50 Mw	Internal combustion	30%–39% in simple cycle; 60% in combined cycle	Commercial
Wind Turbine	500 kw–1.5 Mw	Wind-powered	20–50%	Commercial
Solar Photovoltaic	≤500 kw Depends on array size	Direct generation from sunlight	5–12%	Late emerging stage
Microturbine	25 kw–1 Mw	Internal combustion	20–28%	Early emerging stage
Phosphoric-Acid Fuel Cell	200 kw	Electrolytic process	40% simple 80% cc	Commercial applications
Proton-Exchange Membrane Fuel Cell	1 kw–1 Mw	Electrolytic process	40%	Demonstration stage
Molten-Carbonate Fuel Cell	250 kw–10 Mw	Electrolytic process	55%	Demonstration stage
Solid-Oxide Fuel Cell	1 kw–10 Mw	Electrolytic process	45–50% simple >65% cc with gas turbine	Development stage
Fuel Cell–Gas Turbine Hybrid	<1–20 Mw	Electrolytic process with waste-heat utilization	>65%	Demonstration stage

(Source : Bear Sterns & Co. Inc., Electric Power Research Institute, Graphic by Nancy Soulliard for ENR,)

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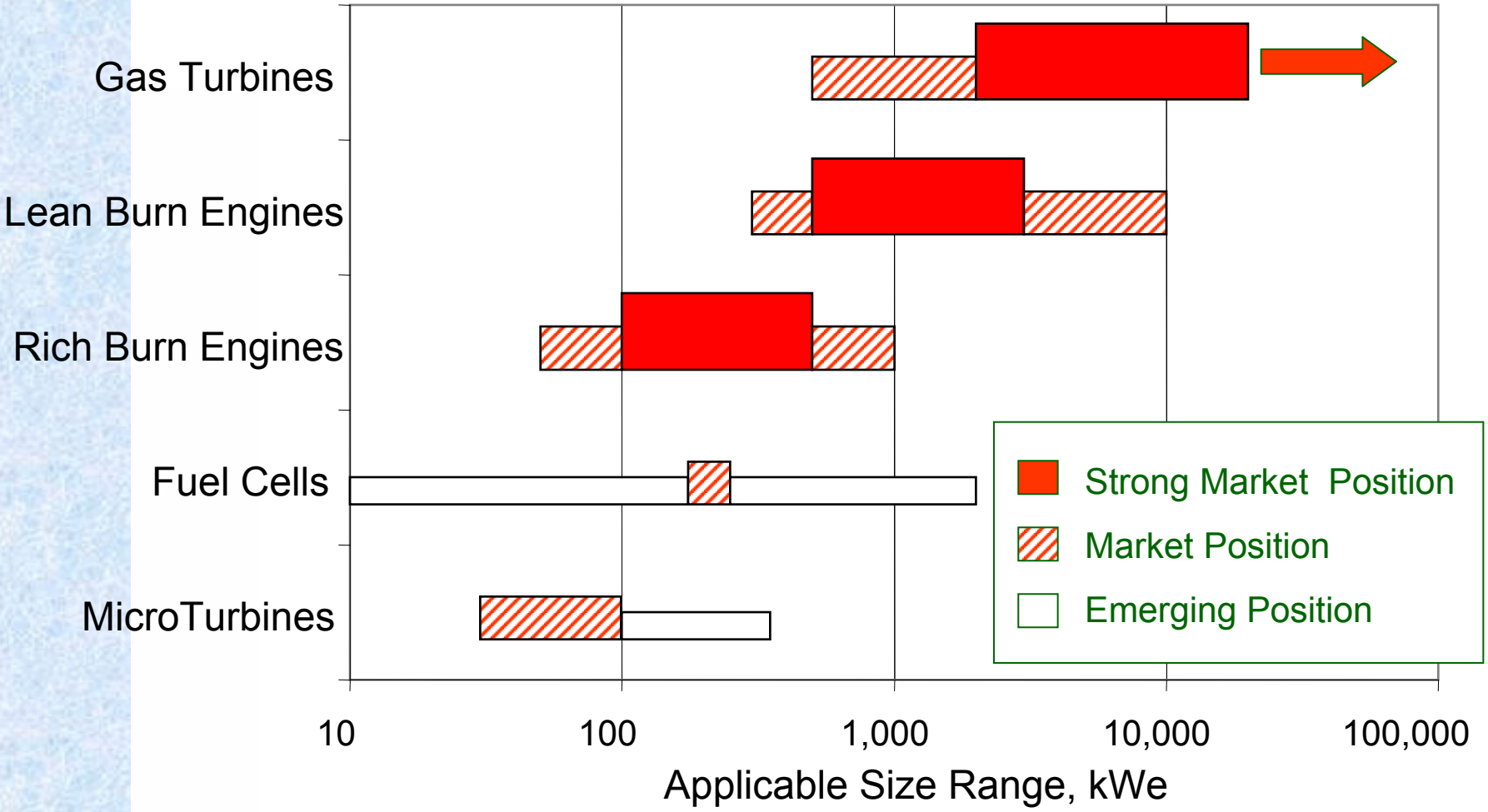
Technology vs Size Coverage



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What Affects Technology Choice and System Design?

- Energy costs and fuel availability
- Electrical load size/factor/shape
- Load criticality
- Thermal load quality/size/shape
- Special load considerations
- Regulatory requirements

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Summary

- Wide range in technology performance in terms of cost, efficiency and emissions
- New technologies being tested in niche markets
- All technologies are improving
- Match to cost, performance, regulatory and risk requirements of the user

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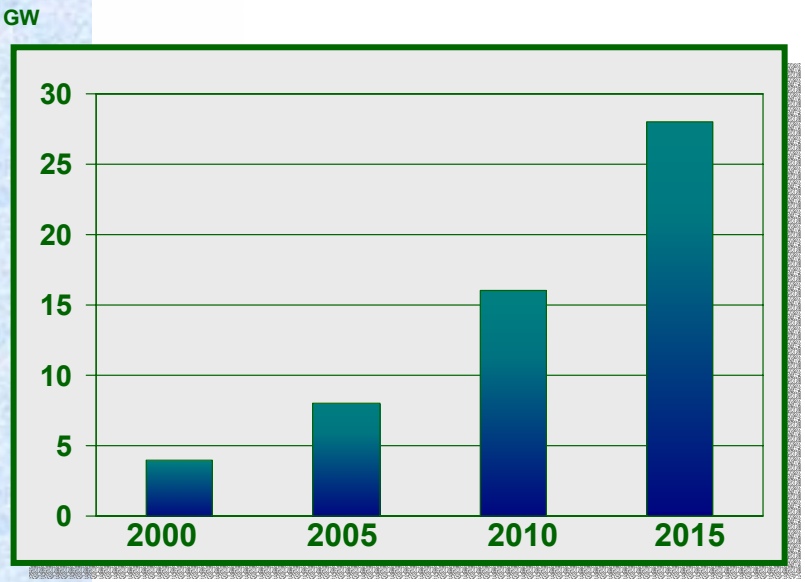
The Future of DG

Distributed Generation Market Projection



GRI [Gas Research Institute] projects a significant long-term market opportunity for smaller scale distributed generation in the U.S. and worldwide. In the short-term, issues like electric utility restructuring will cause market uncertainty that limits market penetration. GRI's projection for the U.S. represents over 27 GW of power and $10 billion of cumulative capital equipment purchases by 2015.

Gas Research Institute

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The DG/CHP Panel

Microturbines	Tony Hines	Bowman Power Systems
Recip Engines	Gordon Gerber	Caterpillar
Comb Turbines	Lisa Marlo Conley	Solar Turbines
Renewables	Janice Lin	Power Light Solar Systems
Fuel Cells	Stephen Torres	Fuel Cell Energy

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